



The Under Secretary of Energy
Washington, DC 20585

November 6, 2003

The Honorable Sherwood Boehlert
Chairman, Committee on Science
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

Thank you for your October 17, 2003, letter requesting a report on the Administration's climate change technology programs, a description of the selection criteria for the climate technology solicitation, and the climate change technology program strategic plan or a timeline for development of the plan.

As I testified before your Committee in February of this year, President George W. Bush's National Climate Change Technology Initiative (NCCTI) is inventorying and prioritizing all climate change activities within the \$1.6 billion technology R&D portfolio that is included in the scope of the Climate Change Technology Program (CCTP). The CCTP is a multi-agency research and development coordination activity, organized under the auspices of the Cabinet-level Committee on Climate Change Science and Technology Integration (CCCSTI).

The CCTP is producing several reports that together will constitute the findings and recommendations of the NCCTI thus far. For example, enclosed you will find a recently-completed report analyzing responses to a November 2002 *Request for Information and Statement of Interest* (RFI) issued by the Department. The RFI analysis is a key component of the NCCTI report in that it helps us understand whether there are important climate change technology concepts that are not being addressed through current research and development activities.

While the analysis identifies some new areas for research that can be pursued either through modifications or improvements to existing Department of Energy (DOE) and other agency procurement strategies or through a future competitive solicitation, it also indicates that existing DOE programs do encompass the vast majority of proposals to research and develop technologies that can help avoid, reduce, or sequester greenhouse gases emissions.

Regarding the selection criteria for the NCCTI competitive solicitation, formal selection criteria have not been developed because Congress has not provided funding for the President's request. The RFI did contain criteria for submittals that would be the basis for those contained in a future solicitation. Those criteria were: (a) future reductions in or avoidances of greenhouse gas emissions; (b) greenhouse gas capture and sequestration (permanent storage); (c) capture and conversion of greenhouse gases to beneficial use; or (d) enhanced monitoring and measurement of greenhouse gas emissions, inventories, and fluxes in a variety of settings. In the event Congress does provide funding for the NCCTI competitive solicitation, the CCTP will formulate formal criteria based on the findings of the RFI analysis.

In addition to the enclosed RFI analysis, the CCTP will publish in December two reports on the Administration's climate change technology portfolio. The first, *U.S. Climate Change Technology Program - Research and Current Activities*, highlights technology initiatives and other important research, development, and deployment activities offering significant potential to contribute to the President's near- and long-term climate change goals. The second, *U.S. Climate Change Technology Program - Technology Options for the Near and Long Term*, is a more comprehensive compendium of baseline climate change technology research, development, demonstration, and deployment activities. Finally, the climate change technology strategic plan will be released as a draft for public comment during the first calendar quarter of 2004.

While I regret the delay in producing these documents, it is important to note that the underlying research and development activities they discuss have been and are moving forward to address the climate change challenge.

Thank you for your continued interest in these vital programs. If you have any questions, please feel free to contact me or Mr. Rick A. Dearborn, Assistant Secretary for Congressional and Intergovernmental Affairs, at (202) 586-4967.

Sincerely,



Robert G. Card

Enclosure

October 2003

**Report on Responses to the Request for Information
Regarding the National Climate Change Technology Initiative
U.S. Department of Energy**

On November 19, 2002, a "Request for Information and Statement of Interest" (RFI) was issued by the U.S. Department of Energy (DOE) to explore the depth and breadth of interest in a potential future competitive solicitation for research on innovative climate change technologies. This RFI was issued in support of the President's National Climate Change Technology Initiative (NCCTI). The RFI closed on January 31, 2003.

In brief, the RFI analysis revealed two benefits. First, the RFI process provided a valuable tool in evaluating and possibly expanding current agency R&D programs. It is possible that future RFIs can provide further ideas for improvements to existing programs. Second, the analysis revealed significant interest in participating in a NCCTI competitive solicitation program. At the same time, the RFI submittals raised a number of procedural issues that will need to be addressed and resolved if an RFP is pursued. Better awareness of these issues can be expected to clarify and strengthen a future NCCTI competitive solicitation program.

Request for Information

As announced in the RFI, as in reference to the NCCTI, the DOE requested information on and expressions of potential interest in a possible, future DOE competitive solicitation on research. If pursued, the research would explore concepts, technologies and technical approaches that could, if successful, contribute in significant ways to: (a) future reductions in or avoidances of greenhouse gas emissions; (b) greenhouse gas capture and sequestration (permanent storage); (c) capture and conversion of greenhouse gases to beneficial use; or (d) enhanced monitoring and measurement of greenhouse gas emissions, inventories and fluxes in a variety of settings.

The RFI mentioned that, if pursued, the NCCTI competitive solicitation could involve the award of tens of millions of dollars in research grants or other forms of financial assistance for research over multiple years. The RFI said that, if pursued, the competitive solicitation would be open to all proposers in order to encourage the broadest possible participation.

As a first step in considering this program, the DOE invited interested parties to submit a Statement of Interest, which would include identification of a point of contact and other information about the party. Parties were also encouraged to submit a brief outline of an idea, concept, technology or technical approach, that would be the subject of research and focus on the above-stated NCCTI objectives.

Summary of Responses

DOE received 180 responses containing at least one proposed idea, concept, technology or technical approach, from a total of 79 different individuals, organizations or other entities. DOE received an additional 16 statements of interest, but with no submitted ideas. A summary of the RFI responses with ideas is provided below.

- ▶ 180 responses (technology ideas) were received, representing the interests or submissions of 79 different organizations or responding entities;
- ▶ 45 of the 79 entities were private sector;
- ▶ 10 of the 79 entities were non-governmental organizations (NGOs);
- ▶ 11 of the 79 entities were universities;
- ▶ A number of entities were States or municipal governments;
- ▶ Numerous additional entities (different from the 79 submitting) were mentioned in various responses as potential partners, contributors or collaborators.
- ▶ An additional 16 entities, beyond the 79 noted above, expressed interest in a future NCCTI competitive solicitation, but did not submit a concept or technology.

Technical Review of the RFI Responses

All 180 RFI responses with ideas were assigned for review to six working groups operating under the auspices of the multi-agency U.S. Climate Change Technology Program (CCTP). The six working groups broadly represented six technical areas: (1) energy production; (2) energy efficiency; (3) CO₂ capture and sequestration; (4) greenhouse gases other than CO₂; (5) measuring and monitoring of greenhouse gases; and (6) supporting basic or strategic research. If concepts or technologies were cross-cutting in nature, or did not fit uniquely in one area or another, such concepts were assigned to multiple working groups, as appropriate.

The resulting RFI reviews, in general, were limited to screening and initial assessments, intended to identify ideas that were relevant to the RFI criteria, innovative, and having overall technical merit. The evaluations were thorough, but not as rigorous as would be expected in a more formal review of responses to a Request for Proposals (RFP) where awards would be made under peer review.

Summary of Technical Review Findings

The overall response (79 entities submitting a total of 180 concepts) was considered reasonable, given that: (i) no funding was offered in the RFI; (ii) the announcement's 42-day open period spanned the Thanksgiving and winter holiday periods; and (iii) no advantage was conferred upon the respondent, vis a vis a future solicitation, from developing ideas and sending them in. Even so, the response should be considered light, compared to what might be expected if substantial

funding were offered. Thus the findings summarized below should not be considered definitive or exhaustive. The technical review findings may be characterized as follows:

- ▶ 25 of 180 RFI responses focused on program management or decision support tools that might help focus R&D on climate change technologies or related concepts.
- ▶ More than 120 of the RFI responses were integrative in nature, or otherwise cut across two or more existing research and development program areas.
- ▶ More than 120 of the RFI responses were rated "high in overall technical merit", vis a vis the goals or criteria as stated in the RFI announcement.
- ▶ More than 90 of the RFI responses were assessed as either falling within the scope of currently funded State or Federal R&D programs, or were consistent with such programs.
- ▶ More than 90 of the RFI responses were assessed as either falling within the scope of currently funded private sector R&D programs, or as consistent with such programs.
- ▶ More than 30 of the RFI responses were assessed as representing ideas or technical areas that would not fall within the scope of currently funded Federal, State, or privately funded R&D programs, if broadly considered.
- ▶ Less than 10 of the RFI responses were simultaneously assessed as high in technical merit, responsive to the RFI criteria, and unique or novel, that is, not easily fitting into the scope of any existing R&D funding program, if broadly considered.

Although most of the 180 concepts submitted were assessed as both having "high technical merit" and being responsive to the RFI goals, few were found to fall outside the competitive purview of one or more of the known existing Federal or privately funded R&D programs. The working groups concluded that most RFI responses would be appropriate for consideration for competition within the scope of existing R&D programs. The working groups were not able to determine from the information provide whether the submitted concepts would be sufficiently competitive to be awarded funding, compared to the universe of other concepts that would be competing for such funding.

RFI responses that seemed appropriate for consideration within the scope of existing R&D programs were forwarded to the appropriate R&D programs for such consideration. The existence of some RFI responses that were evaluated high in technical merit, responsive to the RFI criteria, and sufficiently innovative, novel, cross-cutting or integrative in nature that they did not seem to fit easily into existing R&D funding programs, suggested that there may be some gaps in the existing R&D program structure, where a future NCCTI competitive solicitation might complement others in the larger scheme of a multi-agency U.S. climate change technology R&D program.

Procedural Issues Identified

Beyond the findings of the RFI response technical review, a number of procedural issues, or points of potential confusion, were identified. In the event that a future Request for Proposals

(RFP) should go forward for a future NCCTI competitive solicitation, these issues would need to be clarified or resolved. The reviewers suggested a few potential solutions to some of these issues

- ▶ Apparently, one of the greatest sources of confusion, given the RFI's broad scope, was duplication with ongoing R&D programs, and the reviewer's desire to avoid duplicate or conflicting awards. As long as both sources of funding exist (current programs and the NCCTI solicitation), and as long as both are competing head-to-head with each other, extensive coordination will be required among the NCCTI reviewers and the existing R&D programs in order to avoid conflict or overlap.
- ▶ One solution might be to focus NCCTI research, instead, on selected areas that differentiate themselves from ongoing R&D, cut across multiple Federal program mission areas, or score high on innovativeness or novelty of approach, thereby exploring new or novel areas of technology R&D not covered by existing R&D programs.
- ▶ Another approach would be to encourage proposals with integrated approaches for a more efficient use of research dollars, for example, power production with sequestering CO₂, rather than separate proposals.
- ▶ Many of the RFI submittals identified an idea or an R&D project that is already being accomplished by other efforts. Truly innovative proposals are likely to be rare, given that current R&D programs already have many and highly interactive mechanisms for inviting, unearthing and pursuing promising new research directions. At the same time, it is possible that enhanced R&D along existing lines for some technologies could have some accelerating effects, with resulting beneficial impacts on reducing greenhouse gas emissions. Thus, questions about the relationship between a future RFP and an existing R&D program will need to be spelled out clearly. Some sample issues follow:
- ▶ How will the RFP deal with the varying degrees of overlap of new ideas with existing federal R&D activities?
- ▶ Should a proposer be required to document how a new proposal fits with current federal R&D efforts?
- ▶ How should innovation be defined and/or rewarded?
- ▶ How should an idea be scored that suggests R&D that is already funded under an existing program, or that is closely related to or an extension of an existing program, or that is a specific project that could be funded under an existing program like the Federal Energy Management Program or Building America?

- ▶ Many RFI responses proposed projects that would demonstrate or deploy (extend the use of) existing technology (i.e., develop green building designs, demonstrate energy efficient buildings, or demonstrate use of CNG or H₂ in fleet vehicles). So, another area of confusion arose from questions about differences between R&D and demonstration projects, and how each should be evaluated. A future RFP would need to address this concern and, for example, clearly state that the funding is for "R&D" for climate change technology development, and not for demonstration projects, or alternatively, if demonstration projects are desired, then criteria would need to address how they will be treated, versus R&D.
- ▶ Many RFI responses sought funding support for commercialization of existing technologies, which is generally regarded as a private sector responsibility, and not consistent with the Federal research mission. A future RFP would need to state a clear position on this point stating, for example, that commercialization of existing technologies are not within its scope.
- ▶ Request information on state of development for the technology. It may be helpful to apply the well defined research categories of "6.1 - Basic Research, 6.2 - Applied Research, 6.3 - Advanced Technology Development, " as employed in DoD research and development programs.
- ▶ Clarify the kinds of activities that would be most appropriate and likely to gain Federal support. If it is likely that industry has sufficient motivation to pursue the research for its own benefit, then additional support by the government would not seem warranted.

Other issues arose with respect to who is eligible or not eligible to respond to the RFP and be awarded a Federal grant or contract. Would there be restrictions on non-U.S. firms, or other forms of governments? Some suggestions from the review include the following:

- ▶ Encourage participation and collaboration across sectors (industry, university, and national laboratory), and discourage individual investigations, as a means of enhancing robustness.
- ▶ For truly novel, innovative (i.e., risky and far from commercialization) basic or strategic research, a requirement for industry cost-sharing or co-funding may be counter-productive, as private investment may draw research to more tangible or nearer-term focus, and discourage longer-term, higher risk, but potentially higher payoff, ventures.
- ▶ Encourage collaboration with foreign investigators (possibly patterned after the DOE-NE NERI or I-NERI), so that the best ideas and best teaming arrangements, are available.

A number of other suggestions emerged, provided below, for consideration as a means to clarify responder requirements or otherwise improve the structure and facilitate the review of a future RFP.

- ▶ Provide links to relevant R&D programs and published technology roadmaps at all the agencies participating in the CCTP, in order to assist investigators in accessing information on related programs and technologies and improving their proposals.
- ▶ Require the responder to identify the source of all research funds being used on the proposed initiative. This will help the reviewer with coordination among multi-agency participants.
- ▶ Specifically require information as to whether or not the proposed technology has been submitted elsewhere to other U.S. Government funding programs.
- ▶ Request information on whether the technology is envisioned to be available in the near-term or longer-term. The NCCTI RFP should support a mix of innovative technologies and technology-based solutions – some of which could be brought to market quickly and others which require more sustained R&D over years to decades.
- ▶ Require information on project size and the required investment to achieve its objective.
- ▶ Request information on the applicability and GHG benefits of the technology. It would be useful to have information on the emission sources to which the technology is to be applied, and the magnitude of the impact on greenhouse gas stabilization that the proposed technologies are projected to enable. Impact analysis and assessment would contribute to the prioritization process within NCCTI.
- ▶ Provide guidelines to standardize basic information provided regarding the principal and co-investigators, and their affiliations, and the capabilities of the research team and facilities.

Finally, other issues arose about projects that might better fall under the scope or purview of the Climate Change Science Program (CCSP), rather than the CCTP. This also identified a need to clarify how cross-cutting (CCSP/CCTP) research should be addressed.

Technical Findings Identified

Several responses focused on program management or decision support tools that might help focus R&D on climate change technologies or related concepts. While the majority of the abstracts met the criteria associated with the RFI and rated well with respect to the criteria, decision support tools may be needed to help prioritize and integrate the diverse technology R&D and aid in achieving the long- and short-term missions of CCTP.

With respect to longer-term technologies, technologies and practices that rely on scientific advances, including geo-engineering, precision use of advanced information technologies, and advanced bio-products development, are still at points in their development where basic research and "proof of concept" demonstrations are priorities. Basic research questions also relate to the development and application of advanced technologies. For example, there are many opportunities for research in biotechnology (genomics, genetics, proteomics) that may aid in managing carbon. In addition, basic research is needed in establishing the interactions between efforts to improve carbon storage and nutrient cycling and potential positive and negative impacts on other environmental services.

Most current and proposed R&D explore individual technologies. However, there are possible commonalities and synergisms among the technologies that lend themselves to cross-cutting research activities in some areas. Such possibilities need to be identified and pursued early. For example, many materials issues are similar across a number of technologies, particularly as we look toward advanced technologies that employ higher temperatures and pressures. It would be highly desirable for some of the early NCCTI initiatives to focus on such cross-cutting R&D areas.

Likewise, a number of technologies may be amenable to integrated implementation strategies. While implementation is largely not an R&D activity, there are some analytical issues that need to be addressed to determine compatibility of alternative energy production technologies, optimal configurations, and systems integration issues. These analytical activities are also appropriate to the NCCTI.

Enabling technologies also need to be identified and analyzed. In particular, issues like land use and long-term availability of resources or feedstocks critical to a technology need to be examined. For example, resources and reserves of natural gas, supplies of bismuth for potential lead-bismuth nuclear technology, catalysts for chemical processes associated with energy production technologies, etc., are all critical to the long-term feasibility of some of the technologies. This is an area that has had only fragmentary attention to date and is worthy of analysis under the NCCTI.

In some cases, infrastructure issues may also need to be addressed. This is particularly the case where an accelerated introduction of a technology may be desirable. Infrastructure issues which may be relevant include mining, fabrication, and construction facilities and capabilities. Little work has been done in these areas, particularly for advanced technologies, and NCCTI should initiate some studies, particularly to address accelerated introduction plans.

In this increasingly global economy, energy production resource and infrastructure issues need to be examined on both a national and international basis. In some cases, sufficient national resources and infrastructure will be necessary to ensure national security. However, significant elements of our energy production infrastructure are likely to be imported. In those cases, we need to assure the adequacy of supply globally, considering also the competing global demands

for the supply. Given the importance of an adequate energy supply to national security and economic health, this is an important area for the NCCTI to consider.

The NCCTI competitive solicitation may also wish to encourage proposals to assess how much the potential benefits of using different energy technology options, such as wind, solar, or sequestration might be affected by changes to a future climate, should they occur.

Finally, the solicitation should clearly state that the scope of the RFP includes R&D on all greenhouse gases (GHGs), not just CO₂ or methane. Other gases include nitrous oxide, sulfur hexafluoride, and other chemicals with high global warming potential (GWP).

Complementarity Issues for a Future NCCTI Competitive Solicitation

A number of RFI responses were evaluated as sufficiently innovative, novel, cross-cutting or integrative in concept to warrant further interest, yet did not seem to fit easily into existing R&D funding programs or the established Federal R&D organizational hierarchies, or if they did, they seemed to fit only on the margins, and not likely to gain mainstream support. These responses were not necessarily the best developed RFI responses, but were among some of the more interesting, novel or unique concepts or applications. Although relatively small in number, these RFI responses suggest a number of gaps or potentially fruitful areas of R&D, as characterized below, where a future competitive solicitation might add value uniquely by complementing an otherwise robust Federal program of ongoing R&D in climate change-related technology development.

The following is a generalized list of areas for further consideration, if a NCCTI competitive solicitation program were redirected at complementing, rather than competing with, existing R&D programs. Currently, these areas are not as well represented in the existing R&D portfolio.

- ▶ *Decision-support tools.* Numerous RFI responses proposed various analytical, assessment, software, modeling or other quantitative methods for better understanding and assessing the role of technology in long-term approaches to achieving stabilization of concentrations in the atmosphere. While individual R&D programs sponsor the development of such tools, these are applicable mainly to their respective areas of responsibility or technologies. There is no place where broad-based tools may be applied or integrated across all technologies.
- ▶ *Strategic research.* Strategic research is basic research applied to a particular problem or technological focus area. Many existing agency research programs are either basic or applied in their missions, and so restricted by their appropriations. As a result, strategic research often finds no specific program able or willing to explore novel concepts along unconventional lines.

- ▶ *Applied bio-engineering.* As an example of strategic research, one RFI proposed to search for or engineer unique microorganisms both to produce hydrogen and sequester carbon dioxide. Ideas such as this have not neatly fit into the basic energy research programs of DOE's Office of Science (SC), as they may be too applied, nor do they fit in the energy supply, energy conservation, fossil energy or sequestration R&D programs of DOE's applied R&D programs in FE, EE or NE, as they are too basic and exploratory. The RFI analysis process enabled DOE's Office of Science to examine this concept for inclusion in its procurement strategy.
- ▶ *Integrative concepts.* Integrative concepts cut across R&D program lines and attempt to combine technologies and/or disciplines, and may promise some of the highest results, yet often experience difficulty in finding funding support from any of the areas. Integrative concepts present unique challenges for program lines and are difficult to coordinate across agencies or across traditional R&D program or mission areas.
- ▶ *Novel concepts.* Novel concepts, almost by definition, do not have logical funding homes within the boundaries of traditional R&D organizations. They may build on scientific disciplines outside the routine or expected, may be unfamiliar, or perhaps threatening to other approaches, can suffer poor reviews by tradition-bound peers, or simply present too high of a risk for regular, metric-monitored investments. Yet, novel concepts can promise potentially valuable ways to reduce GHG emissions, reduce GHG concentrations, or otherwise address the effects of climate change, if pursued and explored. Somewhere within the overall program support for climate change technology R&D there needs to be means provided for funding and exploring novel concepts not fitting within regular appropriated R&D programs.
- ▶ *Greenhouse gases other than CO₂.* Beyond CO₂, there are anthropogenic emissions of a number of other greenhouse gases, including methane, nitrous oxide, and several high-global warming potential (GWP) gases. In the near-term, emissions of such gases may be more amenable to capture and control than some of the major sources of CO₂. For some of these gases, near-term technological advances could result in rapidly attainable and cost-effective GHG emission reduction strategies. Although other agencies, such as USDA or EPA, have the agency-leads on inventorying or mitigating emissions of various sources or these other GHGs, technology R&D programs to address opportunities in these areas are needed.
- ▶ *Measuring and monitoring systems.* Accurate measurements underlie many climate related actions and strategies for reducing GHG emissions. Improving the ability to measure and monitor all important greenhouse gases (GHGs), including their emissions, inventories and fluxes, across a variety of media (soil, water, air) and spatial (local, regional) boundaries, is a top priority. RFI responses included innovative-new systems for remote and continuous monitoring of GHGs (not just CO₂). These included detection and location of GHG leaks.

- ▶ *Feedstocks and materials.* Often neglected in the usual emphasis of R&D on energy are the more routine economic activities of heavy industry, mining, manufacturing, agriculture and construction, which require resources, materials, feedstocks and other material inputs to their production processes, all of which have associated GHG emissions in their resource cycles. One RFI concept suggested systematic analytical methods to identify, review and select promising areas for new technologies to be applied to reduce such emissions, capture carbon, or otherwise substitute processes that result in little or no net GHG emissions.
- ▶ *Enabling Technologies.* Enabling technologies contribute indirectly to the reduction of GHG emissions, by enabling the development, deployment and use of other important technologies that reduce GHG emissions. A modernized electricity grid, for example, is seen as an essential step enabling the deployment of more advanced end-use and distributed energy resources needed for reducing GHG emissions.
- ▶ *Exploratory Concepts Augmenting Existing Programs.* Although DOE has well established R&D programs in almost all areas of energy, from end-use energy efficiency, to energy supply, a number of RFI concepts suggest that there may be worthy areas found outside the mainstream focus of current R&D emphasis. Reasons for this may be because the field is broad and the programs need to be more narrowly focused to be productive. The industry cost-sharing requirements may discourage risk taking and long-term ventures. The extensive degree of collaborated processes may result in consensus building around central ideas, rather than on outliers. In DoD, extensive R&D funding is applied, yet one of the most intriguing elements of DoD's overall research program is DARPA, designed to augment and explore novel, but potentially high-payoff technology concepts.

Conclusion

In conclusion, the RFI responses indicated that there is broad interest in participating in a NCCTI competitive solicitation program, should one go forward. The RFI process also provided a valuable tool in evaluating and possibly expanding current agency R&D programs. A wealth of information was provided among the submitted RFIs, and many of these can serve well as test cases for a future RFP or RFI process. At the same time, the RFI submittals raised a number procedural issues that will need to be addressed and resolved if an RFP is pursued. Better awareness of these issues can be expected to clarify and strengthen the focus and intents of a future NCCTI competitive solicitation program undertaken in support of the President's National Climate Change Technology Initiative.